
Photo: Mike Weimer, U.S. Fish & Wildlife Service

Assessment and Tracking Progress

Section 10

Section 10: Assessment and Tracking Progress

Photo: Upper Thames River Conservation Authority

10.1 Introduction

Surveillance and monitoring provide essential information about the state of the Great Lakes ecosystem and measure the success of remediation and protection efforts. The Lake Erie LaMP is responsible for setting goals and identifying management actions to restore and protect the lake, and to track progress towards these goals. Lake Erie Ecosystem Management Objectives have been finalized and once indicators are developed, wherever possible, existing surveillance and monitoring programs will be used to track indicator changes. Where gaps in current programs exist, new programs may be developed.

In 2000, an inventory of monitoring programs in the Lake Erie basin was developed by Environment Canada based on a number of sources of information. Ninety-three independent monitoring programs were underway within the basin. These can be roughly divided into five monitoring categories (Table 10.1). Some of these monitoring programs are lakewide in nature. Others are more localized or created for a single specific purpose. Several of the monitoring programs that are more lakewide-oriented are described below. At this point, these are only examples of some of the programs that the Lake Erie LaMP may utilize, as the LaMP has not yet determined exactly how progress toward meeting LaMP goals will be tracked. Descriptions of several other monitoring programs are presented in other sections of the document.

Table 10.1: Summary of Ongoing Monitoring Efforts in Lake Erie in 2000

Monitoring Category	Number of Programs
Monitoring inputs/outputs of contaminants	19
Ambient contaminant (spatial, temporal, multimedia)	29
Populations (native and exotic) and habitat	34
Health effects monitoring	8
Exotics effects monitoring	10
TOTAL	93

10.2 Improving Binational Coordination of Great Lakes Monitoring *(Prepared by Melanie Neilson, Environment Canada)*

Background

The Binational Executive Committee (BEC), at their fall 2001 meeting, identified a need for improving coordination of monitoring in the Great Lakes. In order to consult and formulate recommendations, Great Lakes Program managers were convened with Monitoring and Research managers at a series of workshops in 2002. Discussions at the workshops focused on the following themes: the development of a monitoring inventory; identification of monitoring needs and gaps; review of existing coordination mechanisms; and proposals for improving coordination. Recommendations forthcoming from these workshops were presented to BEC.

BEC approved the development of a binational, basinwide inventory of Great Lakes monitoring programs to facilitate exchange of information about programs that are ongoing and planned, and binational coordination of monitoring. The Cooperative Monitoring approach, which was initiated on Lake Ontario in 2003, proved to be highly successful; BEC has endorsed the adoption of this approach for each of the lakes on a rotational basis.

Great Lakes Monitoring Inventory

The database infrastructure and web-based input and search applications for the Great Lakes Monitoring Inventory have been developed in-house by Environment Canada. Great Lakes National Program Office staff will make it accessible via a web site at: www.binational.net. Once it is available on-line, all agencies and organizations are invited to input and maintain information on their Great Lakes monitoring programs.

A basinwide monitoring inventory is a necessary first step to improve knowledge sharing and coordination; however, as identified in the IJC's 11th Biennial Report, there is also a need for information management on a binational, multi-agency scale. It is recognized that the ultimate goal is a distributed, inter-operable system, wherein agency data are retained at source and accessed through a common web site (www.binational.net). As a first step towards realizing this, the monitoring inventory will include information on where data/information are housed, and their accessibility.

Cooperative Monitoring Approach

The Cooperative Monitoring approach focuses on coordinating monitoring (and research) for only a couple of key information needs, one lake at a time, and promoting the sharing of data, information, expertise and technology among agencies.

The Cooperative Monitoring approach…

- is an approach that focuses on one lake at a time.
- is NOT an intensive monitoring year, but rather an attempt to coordinate a binational effort to address a few key information needs for that lake as identified by the Lakewide Management process.
- is above and beyond "core" monitoring programs.
- attempts to piggy-back cooperative monitoring efforts on core programs, where feasible, to gain efficiencies.
- does not preclude monitoring and research being done on other lakes that same year.

A rotational schedule to establish "cooperative monitoring" focus years for each of the Great Lakes has been approved by BEC, as follows:

2003 — Lake Ontario
2004 — **Lake Erie**
2005 — Lake Michigan (U.S.) / Lake Superior (CDN)
2006 — Lake Superior (binational effort)
2007 — Lake Huron
2008 — Lake Ontario
2009 — **Lake Erie**
2010 — Lake Michigan (U.S.) **/ Lake Erie** (CDN)
2011 — Lake Superior

It cannot be stressed enough that these focus years will NOT preclude scientific work or other monitoring being conducted on the other lakes.

The Cooperative Monitoring Steering Committee will work with the Lake Erie LaMP to establish information needs and to bring together the necessary expertise to develop and implement monitoring programs to address those needs for the year focusing on Lake Erie.

The planning for the Lake Erie Cooperative Monitoring in 2004 is well underway. Based on key information needs that were identified at a workshop held in Windsor on November 14, 2003, the Lake Erie Cooperative Monitoring will focus on the following themes:

1. Distribution and abundance of dreissenid mussels;
2. Improved understanding of lake physics and basin exchange; and
3. Nutrient loadings from tributaries and key sewage treatment plants (STPs).

Binational expert teams have been established to further scope out the issues, and to develop monitoring plans. Implementation will be facilitated by the Steering Committee.

While it is recognized that the 2004 Cooperative Monitoring year on Lake Erie will not address all of the information needs, the binational efforts underway will serve to move the yardstick forward for a few key needs.

Photo: U.S. Fish & Wildlife Service, Mike Weimer

10.3 Marsh Monitoring Program
(Reproduced from Lake Erie LaMP 2002 report)

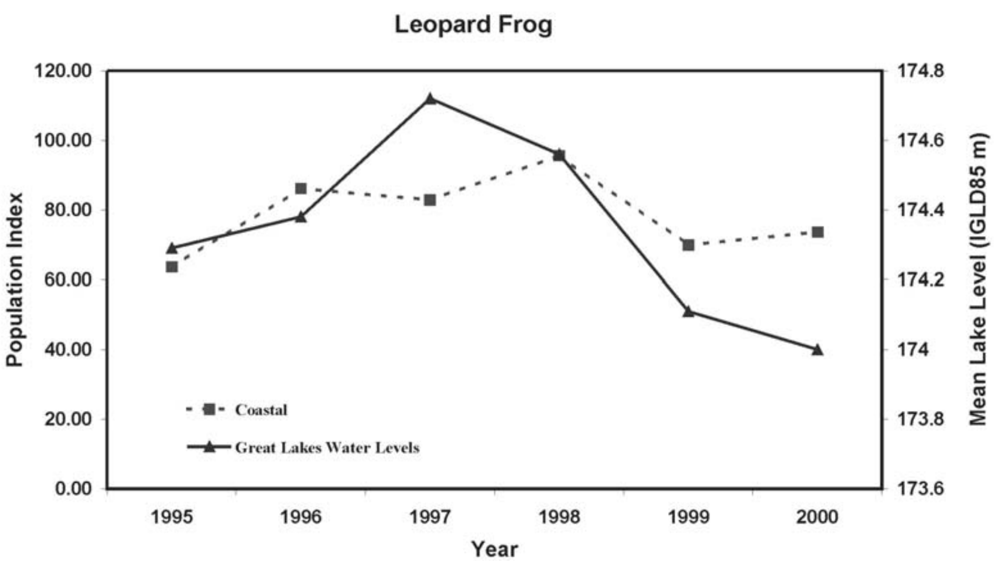
Since 1995, this volunteer based program has engaged both professional and dedicated citizen naturalists throughout the Great Lakes region (including Lake Erie) to record and monitor annual trends in populations of several calling-amphibian (frogs and toads) and marsh bird species in important marshes throughout the basin. Information gathered through the Marsh Monitoring Program is relevant for assessing relative population changes in these species at local, regional and basinwide scales, and can be useful for gauging the status and ecological integrity of marshes at each of these scales.

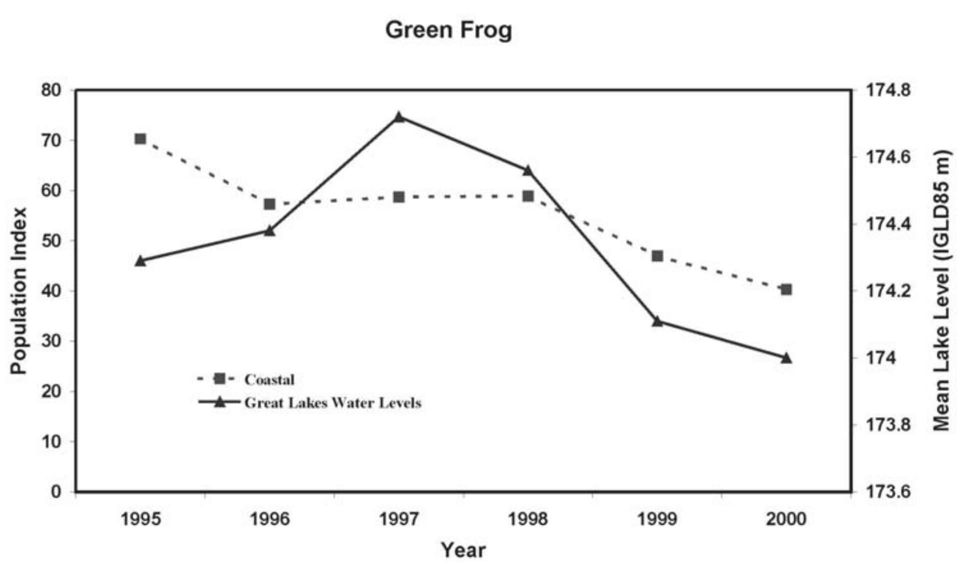
Results (1995-2000) suggest that there appears to be a relationship emerging between population trends of some marsh bird and amphibian species in coastal marshes and the trend in Lake Erie's mean annual water levels, especially since 1997, the year that marked the end of the last sustained high water period. For example, black tern and sora trends at coastal marshes have followed a similar pattern to that of Lake Erie's water levels. Similarly, trends for aquatic amphibian species such as green frog and northern leopard frog have closely reflected the trend in Lake Erie's water levels at coastal marshes. Conversely, trends for certain marsh bird species preferring drier marsh edge habitat have increased at coastal marshes during recent lake level declines. For example, the trend for common yellowthroat (a marsh edge preferring warbler) at coastal Marsh Monitoring Program routes has been inversely related to Lake Erie's water levels (Figure 10.1).

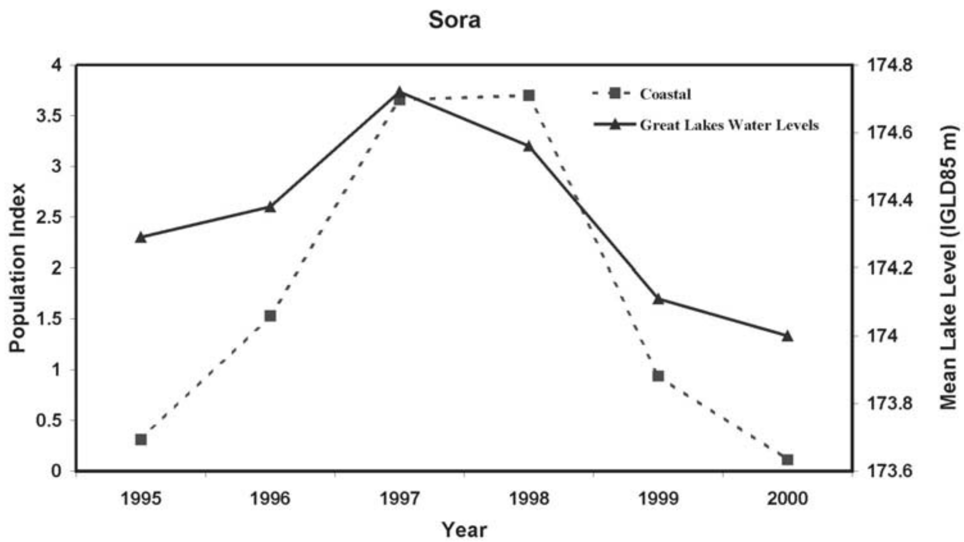
These relations could be explained in part by spatial movement of certain species into or out of Marsh Monitoring Program survey routes. Alternatively, as lake levels declined, if appropriate marsh habitat was not replaced at the rate at which it was lost, and appropriate marsh habitat was either not available elsewhere or was already at its carrying capacity, then declining trends in highly marsh dependent birds and amphibians may well be indicative of overall population declines.

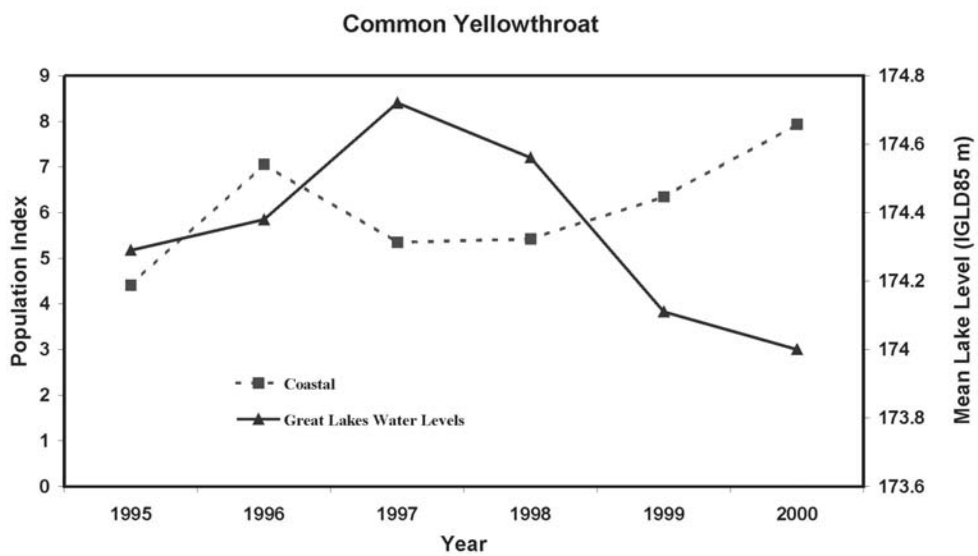
Although current lake levels are near their long-term lows, because lake levels fluctuate, and trends in certain marsh bird and amphibian species at coastal marshes appear to respond to changing lake levels (positively or negatively), when Lake Erie's levels begin to increase again, these responses should be detected by Marsh Monitoring Program data. Only by taking into account the dynamic nature of coastal marsh habitats can one examine what is really happening to populations of marsh birds and amphibians in the Lake Erie basin.

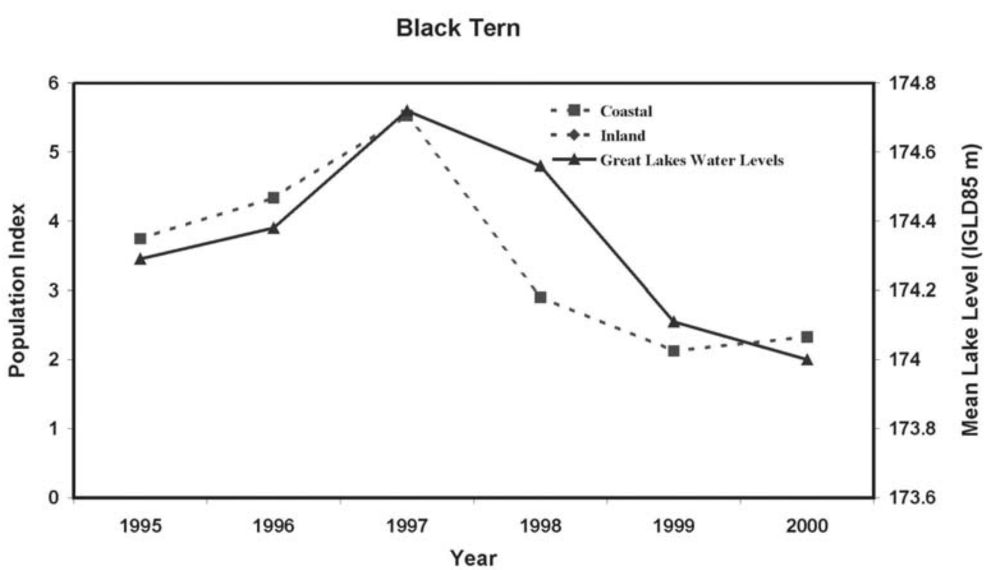
Figure 10.1: Lake Erie basin-wide trends in relative abundance of selected marsh bird and amphibian species compared to mean annual water levels of Lake Erie from 1995 to 2000. For each species, trends are presented for marshes monitored at coastal locations (i.e. within 5 km/3 miles from a lake shore).






Sora
Coastal
Great Lakes Water Levels
Population Index
Mean Lake Level (IGLD85 m)
Year
1995
1996
1997
1998
1999
2000


Common Yellowthroat
Coastal
Great Lakes Water Levels
Population Index
Mean Lake Level (IGLD85 m)
Year
1995
1996
1997
1998
1999
2000


Black Tern
Coastal
Inland
Great Lakes Water Levels
Population Index
Mean Lake Level (IGLD85 m)
Year
1995
1996
1997
1998
1999
2000

Bald Eagle Update

Bald eagles continue to be a highly visible indicator of the state of the Great Lakes. Most of the bald eagles nesting in the Lake Erie basin are found in Ohio, particularly in the marshes in the western basin. In 1979, Ohio had only four nesting pairs along the southwestern Lake Erie shoreline and the eagles along Ontario's Lake Erie shoreline produced no young. Exposure to pesticides, particularly DDT and its breakdown product DDE, proved to be the barrier to successful bald eagle reproduction. Reduction in pesticide use slowly decreased the amount of contaminants in the birds. 1980s programs of hacking healthy eaglets in nests in the western basin marshes, and transplanting healthy adult bald eagles to the Long Point area have greatly improved the population status.

The 2000 nesting year was excellent for Ohio Lake Erie eagles with an 83% success rate and an average 1.4 fledglings per nest. 63 nesting pairs produced 89 fledglings (ODNR). In 2000 the Ontario shore of Lake Erie fledged 21 birds from 14 nests, a rate of 1.5 fledglings per nest (Whittam 2000). Eagle populations continue to grow both along the shore and further inland. Younger birds are starting to build nests closer to human disturbance, and more nests are being found further east and inland. In 2002, 107 eaglets fledged from 58 nests statewide in Ohio. In 2003, 88 nesting pairs in 34 (out of 88) Ohio counties produced 105 young. A record-breaking 105 bald eagle nests have been documented in Ohio statewide at the beginning of the nesting season in 2004.

Although populations continue to increase, the inland populations are increasing faster than the Lake Erie based populations. Also, although the reproductive success is improved, the birds are not living as long. Bald eagle pairs generally return to the same breeding territory, and often use the same nest. However, there appears to be a high rate of turnover for breeding birds. Bald eagles can live to be about 28 years old in the wild but the birds in the southern Great Lakes are only surviving for 13-15 years.

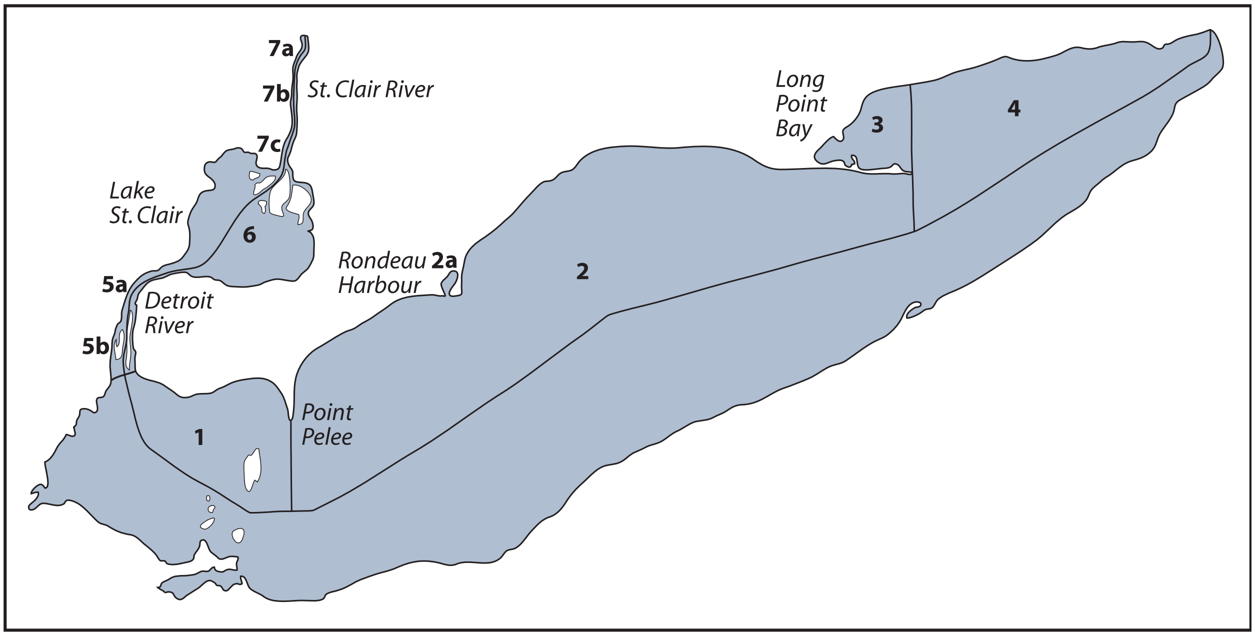
The Ohio Lake Erie Protection Fund provided a grant in 2000 to analyze blood and feather samples collected and archived by the Ohio Department of Natural Resources in the 1990s. PCBs, DDE, chlordane and dieldrin are still found at significant levels (Roe et al. 2004). Elevated levels of mercury and lead have been found in birds in the Long Point area on the Canadian shore. Additional research by Bird Studies Canada and the Ontario Ministry of Natural Resources is being done to track sources of mercury and lead in the bald eagles' diet.

Photo: U.S. Fish & Wildlife Service, Dave Menke

10.4 Trends in Contaminants in Ontario's Lake Erie Sport Fish *(Reproduced from Lake Erie LaMP 2002 report and updated in 2004, prepared by Al Hayton, Ontario Ministry of the Environment)*

Sport fish contaminant monitoring in Ontario is coordinated by the Ontario Ministry of the Environment and conducted in partnership with the Ontario Ministry of Natural Resources. Sport fish from the Canadian waters of Lake Erie have been monitored on a regular basis for contaminants since the 1970s. Size and species-specific consumption advisories for different regions or blocks of the lake (Figure 10.2) are provided to the public in the *Guide to Eating Ontario Sport Fish*.

Figure 10.2:Lake Erie blocks



Consumption advisories, provided as the recommended maximum number of meals per month, are based on health protection guidelines developed by Health Canada. Consumption restrictions in Ontario on Lake Erie sport fish are caused by PCBs (82%) and mercury (18%). In 2002 these percentages were 70% and 30%, respectively. Other contaminants such as DDT and metabolites, hexachlorobenzene, octachlorostyrene, chlordane and lindane are often detected in Lake Erie sport fish, but do not cause consumption restrictions, and concentrations have declined over the years. In recent years, dioxins and furans have been monitored in species expected to have the highest concentrations (e.g. carp, lake whitefish), but have not caused consumption restrictions. Comparing data across the Canadian waters of the Great Lakes, Lake Erie has the lowest proportion of sport fish species with consumption restrictions at 15.7% (in 2002 that number was 17.4%). The proportion of sport fish species with consumption restrictions in the Canadian waters of the other Great Lakes ranges from 21.1% in Lake Huron to 41.1% in Lake Ontario.

In order to report on spatial and temporal trends in contaminants, a "standard size" was selected for each species. The standard size was close to the mean length for the species in the database and typical of the size caught and consumed by anglers. Contaminants in standard size sport fish for the last 10 years were used to evaluate spatial trends. Contaminant data from Block 1 from 1976-2000 were separated into 5-year intervals for temporal trend evaluation. Species selection was based on the availability of data.

Mercury concentrations exhibit no spatial patterns across Lake Erie blocks. Mercury concentrations in 30 cm white bass ranged from 0.09 to 0.15 ppm and in 45 cm walleye from 0.10-0.13 ppm. For both species there was no significant difference across the three major blocks of Lake Erie (Figures 10.3 and 10.4). Block 3 (Long Point Bay) was excluded from the statistical analysis because of the lack of replicate data. Over the past 25 years, mercury concentrations in Lake Erie sport fish have declined. When a comparison was made of the mercury concentrations in white bass in five year intervals between 1976 and 2000 it was found that mean concentrations in 30 cm white bass decreased significantly from 0.22 ppm in the first period (1976-1980) to 0.13 ppm in the last period (1996-2000). The same was found for walleye. Mean mercury concentrations in 45 cm walleye decreased from 0.30 ppm to 0.12 ppm in the same time period (Figures 10.5 and 10.6). Most of the decrease occurred between the 1976-1980 period and 1981-1985. Between 1981-1985 and 1996-2000, there was no significant difference in mercury concentrations in either white bass or walleye. Mercury concentrations in most Lake Erie sport fish are low and only the largest individuals tend to exceed the consumption guideline of 0.45 ppm. White bass and walleye do not exceed the guideline until they exceed 40 cm and 70 cm in length respectively (Figure 10.7).

Analysis of spatial patterns of PCBs for 30 cm white bass suggests that there is little difference in PCB concentrations between blocks in Lake Erie (Figure 10.8). Lower levels found in block 4 are based on only one year of data so statistical significance could not be determined. Over the past 25 years, PCB concentrations in some but not all species of Lake Erie sport fish have decreased. Mean PCB concentrations in 30 cm white bass decreased significantly from 615 ppb in 1976-1980 to 242 ppb in 1996-2000 (Figure 10.9). Most of the decrease occurred between the 1976-1980 and 1981-1985 periods.

PCB concentrations in channel catfish appear to have decreased (Figure 10.10) but lack of replicate data for some periods prevented statistical confirmation. The highest PCB concentrations were found in 1981-1985 (3225 ppb). By the 1996-2000 period mean PCB concentrations had declined to 1143 ppb. PCB concentrations in carp do not appear to have declined over the period of sampling and in the most recent period (1996-2000) were still in excess of 2000 ppb (Figure 10.11). Differences among species may be due to the residual effects of sediment-bound PCBs. Pelagic species such as white bass would be less affected by sediment-bound PCBs than benthic-feeding species such as carp. Although PCB concentrations are low in most Lake Erie sport fish, high lipid species such as channel catfish and carp exceed the consumption guideline of 500 ppb even in relatively small individuals (Figure 10.12).

The Ontario Ministry of the Environment, through the Sport Fish Contaminant Monitoring Program, continues to monitor Lake Erie sport fish for trends in contaminant concentrations and provides consumption advice to anglers.

Figure 10.3: Mercury concentrations in 30 cm (12 inch) white bass across Lake Erie 1990-2000

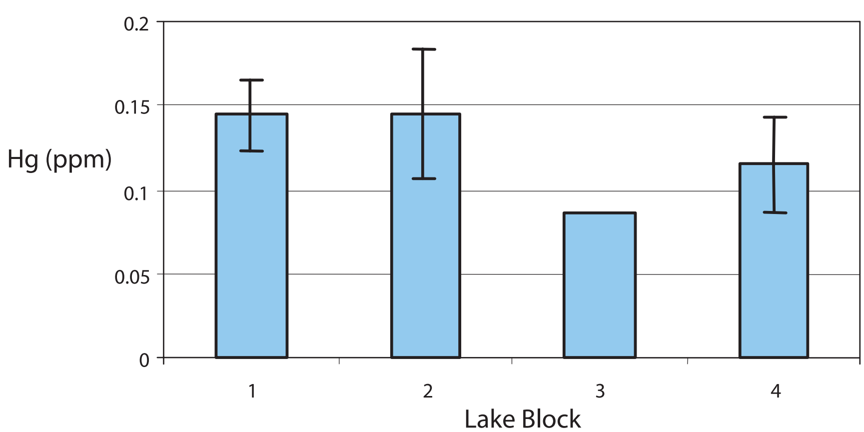


Figure 10.4: Mercury concentrations in 45 cm (18 inch) walleye across Lake Erie 1990-2000

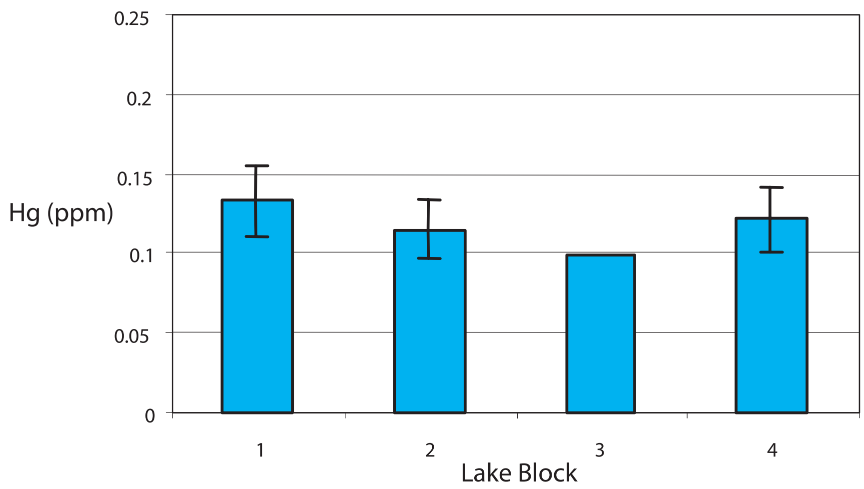


Figure 10.5: Mercury concentrations in 30 cm (12 inch) white bass over time in Lake Erie block 1

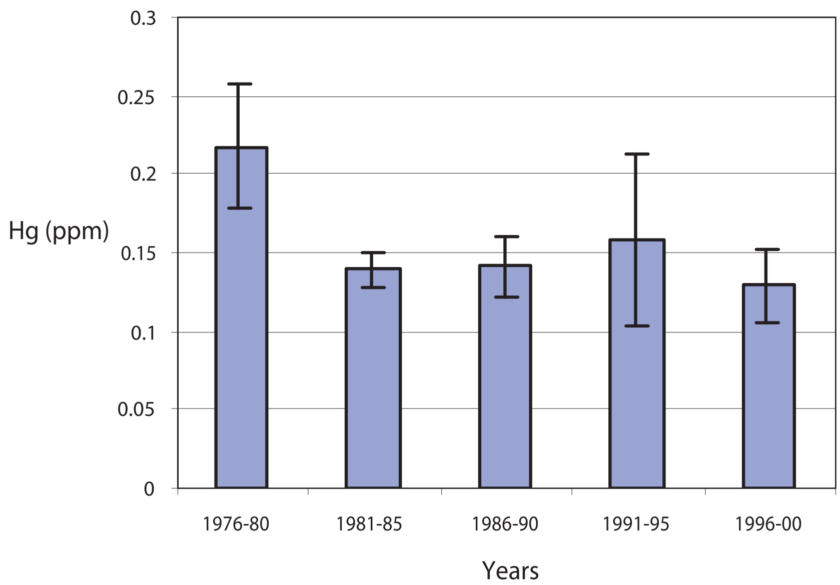


Figure 10.6: Mercury concentrations in 45 cm (18 inch) walleye over time in Lake Erie block 1

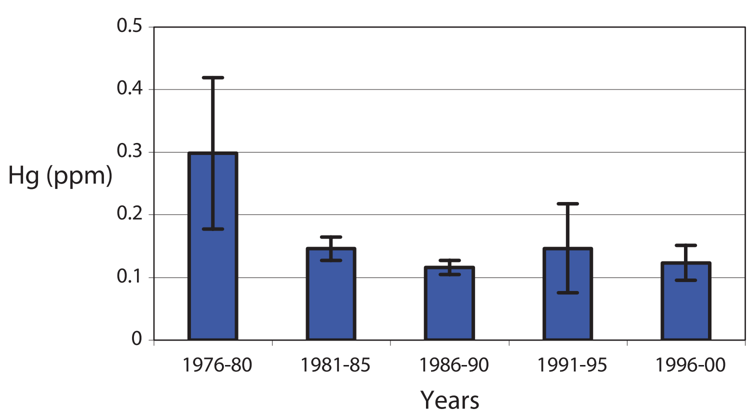


Figure 10.7: Mercury concentration vs. length in walleye and bass from Lake Erie block 1

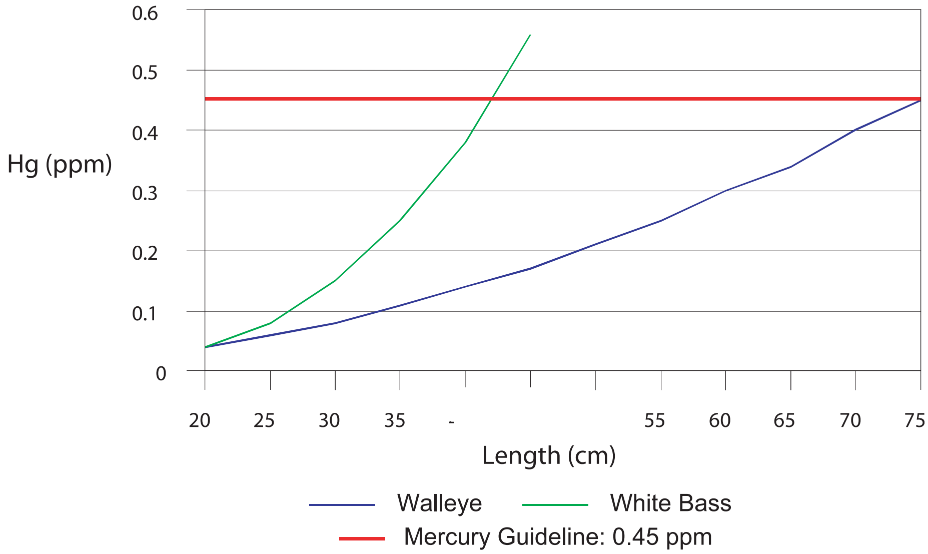


Figure 10.8: PCB concentrations in 30 cm (12 inch) white bass across Lake Erie 1990 - 2000

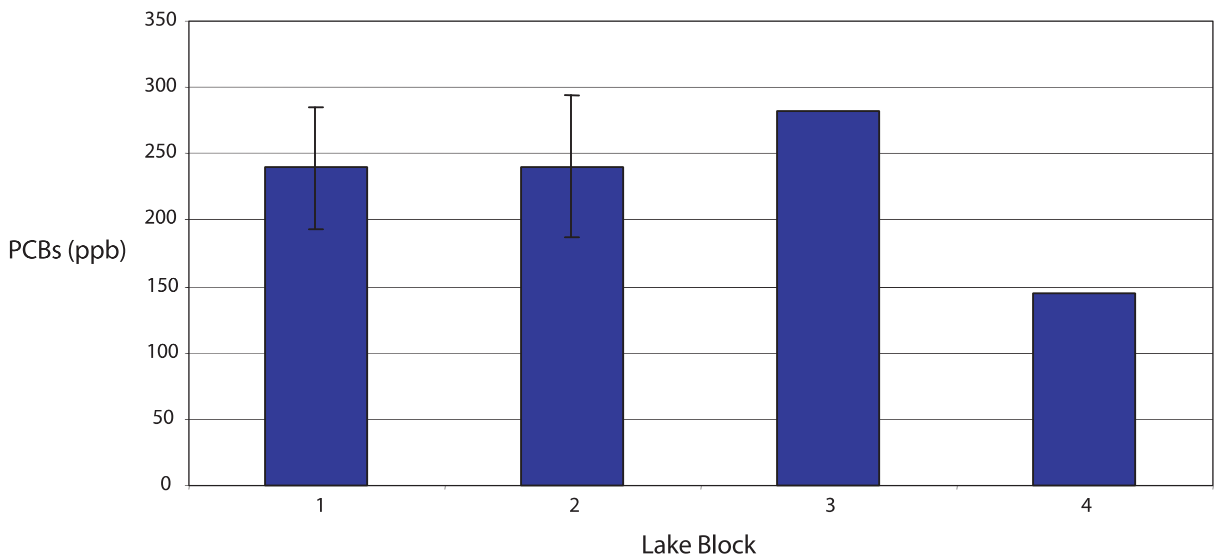


Figure 10.9: PCB concentrations in 30 cm (12 inch) white bass over time in Lake Erie block 1

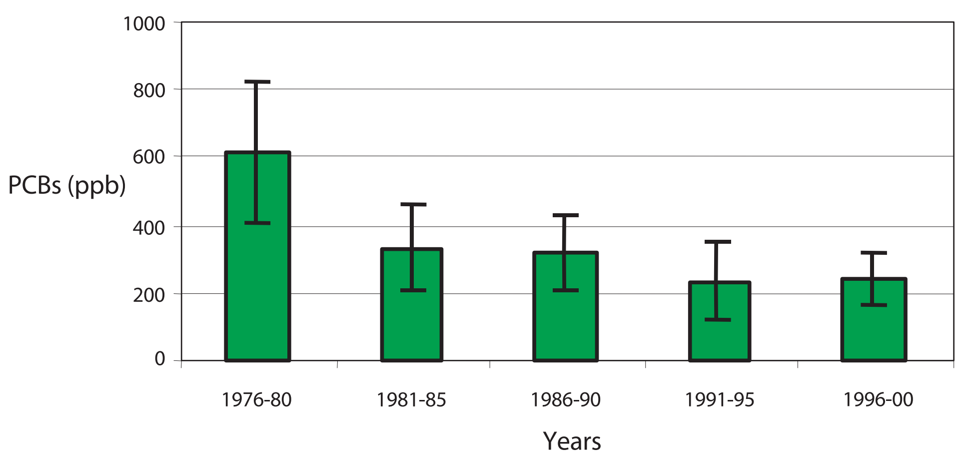


Figure 10.10: PCB concentrations in 45 cm (18 inch) channel catfish over time in Lake Erie block 1

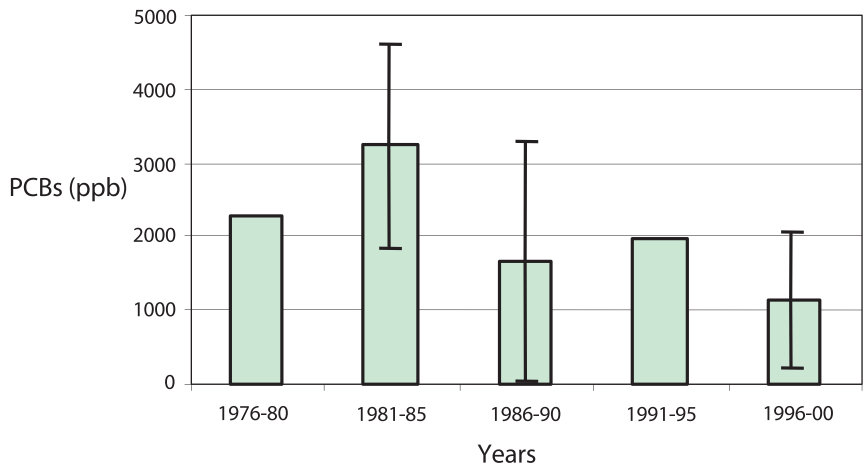


Figure 10.11: PCB concentrations in 65 cm (25 inch) carp over time in Lake Erie block 1

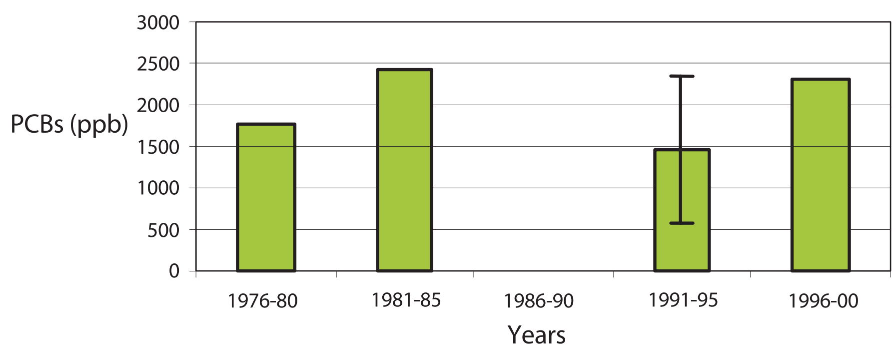
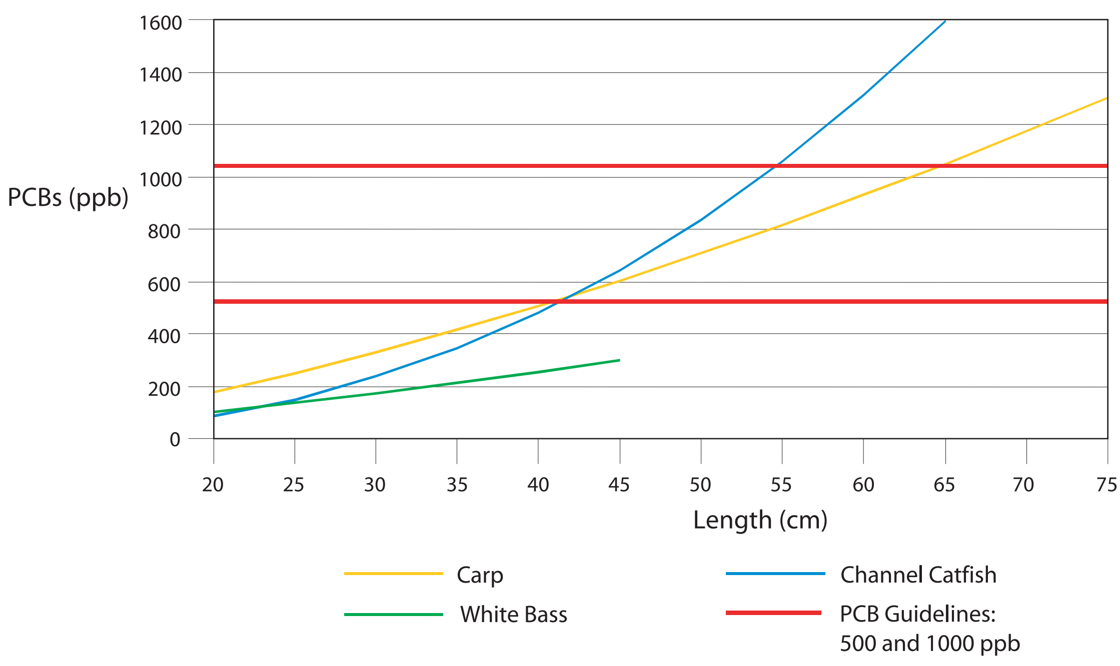


Figure 10.12: PCB concentration vs. length in fish from Lake Erie block 1



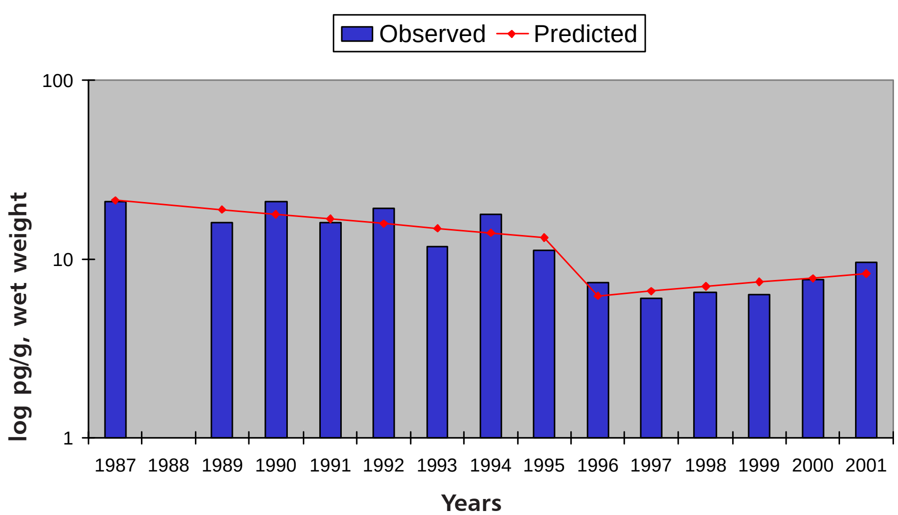
10.5 Trends in Contaminant and Population Levels of Colonial Waterbirds *(Reproduced from Lake Erie LaMP 2002 Report, prepared by Chip Weseloh, Environment Canada - Canadian Wildlife Service)*

The Wildlife Toxicology Section of the Canadian Wildlife Service (Ontario Region) maintains two wildlife-monitoring programs on the Great Lakes: contaminants in herring gull eggs and population levels of breeding colonial waterbirds. The former program was last reported on for the two Lake Erie sites, Middle Island and Port Colborne Breakwall, in 1999. The latter program is only conducted in its entirety once every decade and the most recent report is now available.

Contaminant levels in herring gull eggs do not change very much from year to year, and year-to-year changes do not necessarily have much meaning in long-term trends. Significant changes in long-term trends are usually only seen over several years. For example, Figure 10.13 illustrates an increase in 2,3,7,8 TCDD (dioxin) in herring gull eggs at Middle Island over the last three years but, compared to longer-term observations, there is not an increasing or decreasing trend. Figure 10.14 likewise shows an increase in PCB in herring gull eggs at the Port Colborne site in 2001, but the overall long-term trend is downward. The overall changes in concentrations of the other contaminants measured under this monitoring program (DDE, hexachlorobenzene, mirex, heptachlor epoxide and dieldrin) were variable over the last three years, but the overall trend is significantly downward.

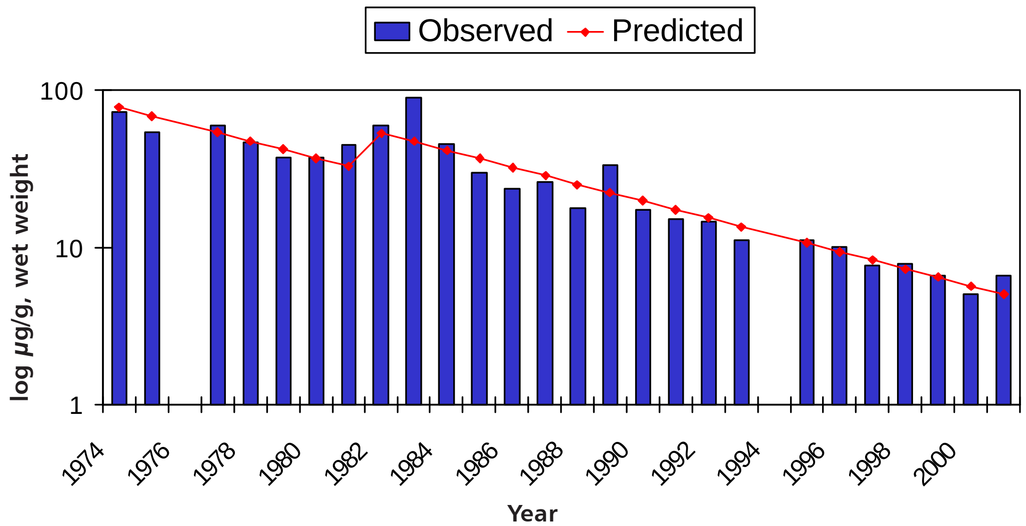
Breeding populations of colonial waterbirds on Lake Erie were surveyed in the late 1970s, 1980s and the 1990s. During the last two decades, populations of herring and ring-billed gulls, and common terns have declined from 14.7 to 18.3%. This is consistent with similar patterns for these species in the other Great Lakes. The number of breeding gulls has declined probably as a result of artificially high population levels in the 1980s, when forage fish populations were larger. Common terns have declined probably as a result of ongoing nest site competition with ring-billed gulls. Double-crested cormorant populations in Lake Erie have increased 211% since the late 1980s. Their populations have been increasing in each of the Great Lakes since the late 1970s. Great black-backed gulls and Caspian terns have just started nesting in Lake Erie (at Mohawk Island at the mouth of the Grand River) and have not yet established themselves there on an annual basis.

Figure 10.13: 2378-TCDD in herring gull eggs - Middle I., 1987-2001



Model shows a significant decline before the change point year in 1996 and a non-significant trend after the change point.

Figure 10.14: PCB 1:1 in herring gull eggs - Port Colborne, 1974-2001



Model shows the same significant rate of decline before and after the change point in 1982.

10.6 Ohio Lake Erie Quality Index

In 1998, the Ohio Lake Erie Commission released the Ohio State of the Lake Report. For this report ten indicators were developed to measure environmental, economic and recreational conditions as related to the quality of life enjoyed by those living near or utilizing the Ohio waters of Lake Erie. Each indicator is composed of several metrics that were selected because they had measurable goals or endpoints against which progress could be measured and, in most cases, some regular monitoring was already being done. These indicators, called the Lake Erie Quality Index, will be updated in 2004. The ten indicators developed in 1998 are presented in Table 10.2.

Table 10.2: Ohio Lake Erie Quality Index Indicators

Indicator	Rating
Water Quality	Good
Pollution Sources	Fair
Habitat	Fair
Biological	Good
Coastal Recreation	Good
Boating	Good
Fishing	Excellent
Beaches	Good
Tourism	Excellent
Shipping	Fair

Additional analysis over the past five years has somewhat altered the metrics used to determine several of the indicators. The Water Quality Indicator has been split into two indicators: one that addresses ambient conditions (water chemistry, water clarity, contaminants in bald eagles, and contaminated sediment) and one that addresses human exposure risks (fish consumption advisories, beach closings and drinking water). The biological indicator has been expanded to include an index of biological integrity (IBI) for shoreline and tributary fish, offshore fish, offshore plankton, key indicator species and coastal wetlands. Tourism and shipping have been combined into one indicator titled Economy.


Photo: Scott Gillingwater

10.7 State of the Lakes Ecosystem Conference (SOLEC)

In response to a reporting requirement of the Great Lakes Water Quality Agreement, in 1994 U.S. EPA and Environment Canada initiated the State of the Lakes Ecosystem Conference, more universally known as SOLEC. It provides a forum for the exchange of information on the ecological condition of the Great Lakes and surrounding lands. SOLEC focuses on the state of the Great Lakes ecosystem and the major factors impacting it, rather than on the status of programs needed for protection and restoration, which is more of the LaMPs' role. In 1998, SOLEC began an effort to develop standard indicators that could be used to better report out on the status of the Great Lakes in a more consistent manner. SOLEC reviewed a number of possible indicators and is currently refining a list of 80 for their potential utility in measuring conditions across the Great Lakes. The work of the SOLEC team will be utilized wherever possible as the Lake Erie LaMP develops the indicators that it will use to track Lake Erie LaMP progress. In 2004, SOLEC will focus on indicators of physical integrity.

10.8 References

Environment Canada. 2001. Bald eagle populations in the Great Lakes region. Great Lakes Fact Sheet. Canadian Wildlife Service. www.on.ec.gc.ca.

Roe, A.S., A.H. Birrenkott, M.C. Shieldcastle, W.W. Bowerman, K.A. Grasman, and J.M. Wing. 2004. Developing the bald eagle as a Lake Erie biosentinal: Contaminant trends in nestling bald eagles in Ohio. Final report for Ohio Lake Erie Protection Fund grant.

Whittam, B. 2000. Southern Ontario bald eagle monitoring project. 2000 Report. Bird Studies Canada.